Document Projet / Project Document			
	GLAST LAT CAL **Mechanical Structure**	Ref :	GLAST-LLR-RP-065
		Issue :	draft
		Date :	
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PEM Mechanical Structure Assembly Procedure

SLAC Reference: LAT-PS-01232-01

Change History log

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Ind.	**Date**	**Modifications**	**Prepared**	**Checked**	**PA Approval**	**Project Approval**

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List of Acronyms

AIT	Assemblage, Integration et Test
AFEE	Analog Front-End Electronic
CAL	sous-système calorimètre du LAT
CDE	Crystal-Diode Element
CEA	Commissariat à l'Energie Atomique
CNES	Centre National d'Etudes Spatiales
DCI	Dossier de Contrôle des Interfaces
DCF	Dossier de Fabrication et de Contrôle
DD	Dossier de Définition
DJD	Dossier Justificatif de la Définition
EM	Engineering Model
EMC	Electromagnetic Compatibility
EGSE	Electric Ground Support Equipment
GLAST	Gamma-Ray Large Area Telescope
LAT	Large Area Telescope
LLR	Laboratoire Leprince-Ringuet
LPNHE	Laboratoire de Physique Nucléaire des Hautes Energies
N/A	Not Applicable
NRL	Naval Research Laboratory
PCB	Printed Circuit Board
SLAC	Stanford Linear Accelerator Center
STB	Spécification Technique de Besoin
TBR	To Be Resolved
TBD	To Be Defined
TBC	To Be Confirmed

1 ENVIRONMENT

The assembly should be performed in a clean room ISO 7 class or better with a temperature controlled at 20±2 °C and a humidity of 50% HR max. Because of the photodiodes and the electronics, a lower limit of the relative humidity should preferably be defined.

2 PEM MECHANICAL STRUCTURE ASSEMBLY

2.1 EQUIPMENT

The following equipment is required for the assembly:

- 3M transfer tape VHS F9460PC for EMI shield assembly
- Torque control screwdriver with M4 and M5 bits for socket head fasteners
- Locking adhesive for fasteners: room temperature curing epoxy glue (3M Scotch-weld EC 2216 or equivalent)

The following additional equipment is recommended:

- Applicator for epoxy adhesive
- Four ϕ3 pins, 8 to 12mm long for removal of old base plate

2.2 LIST OF PARTS

Part name	Drawing number	Number	Material
Composite Structure	GLR-LLR-00-02-B	1	HS carbon fibers, epoxy resin
EMI Shield foil	GLR-LLR-00-20-A	1	Al99 Pure aluminum
Top frame	GLR-LLR-00-01-A	1	2618A T851 Aluminum
Base plate	GLR-LLR-00-06-C	1	2618A T851 Aluminum
Fastener	ISO 4762 M4x8	16	A-286
Fastener	ISO 4762 M5x12	25	A-286

2.3 ASSEMBLY OF EMI SHIELD FOIL

2.3.1 *Removal of the top frame*

2.3.2 *Bonding of the EMI shield*

The EMI shield is a 0.1mm thick aluminum foil (99% pure aluminum) with ALODINE 1200 coating on both sides. The foil is to be bonded on the top of the composite structure using transfer adhesive. Care is required to successfully apply the foil flat on structure. Any contact between the aluminum foil and the tape should be avoided until the foil has passed around all the inserts. The foil has been cut from a roll and should have a curved shape. That should help.

The recommended procedure is:

- Apply transfer adhesive on the top of the composite structure as per figure 1
- Use shims along 2 sides of the structure to make sure the foil will not touch the tape.
- Make sure it is correctly oriented (see figure 2)
- Pass the foil around the 16 top inserts
- Put in contact the center of the foil with the structure once it is engaged in all the inserts

- Apply the foil on the top of the structure starting from the center to the edges
- Remove the 2 shims and apply the edges

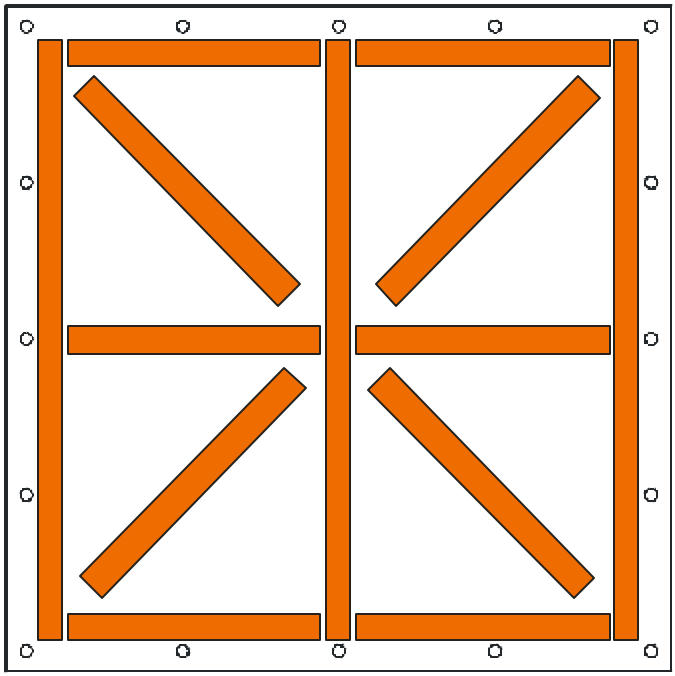

Figure 1: Transfer tape on top of the structure

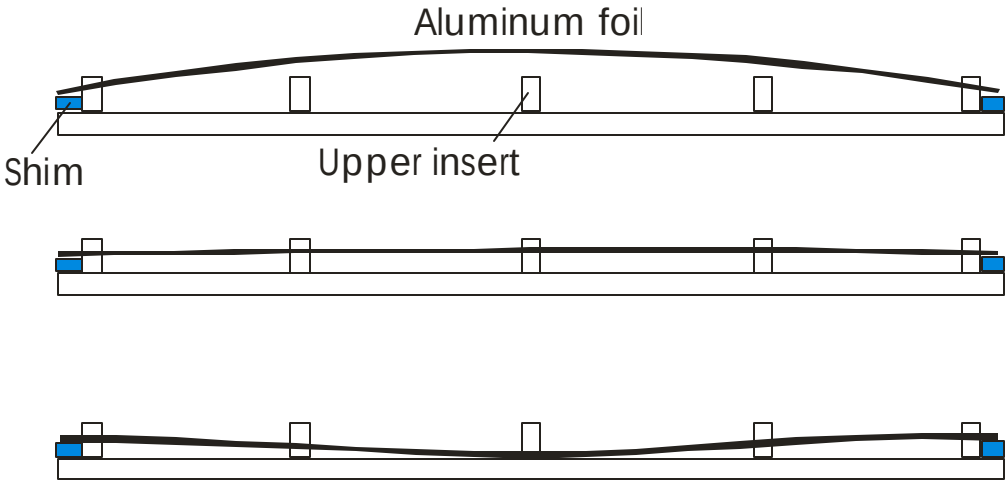

Figure 2: Applying the aluminum foil on top of the structure

2.4 ASSEMBLY CHART

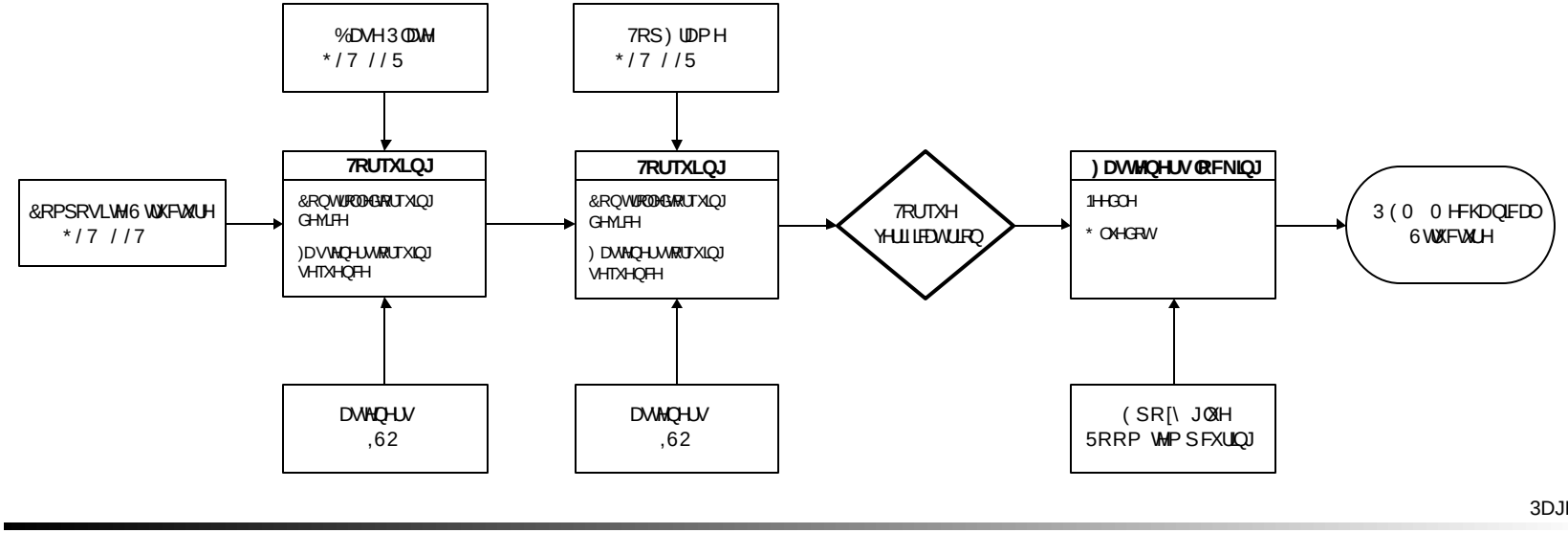

Figure 3: PEM structure assembly chart

2.5 BASE PLATE ASSEMBLY

2.5.1 Old base plate removal

The old base plate need to be first removed from the composite structure. Because a few inserts are not perpendicular to the surface of the composite structure (see NCR GLAST-LLR-FA-012), the base plate might be slightly stuck in place. If that's the case, the 4 M4 threaded holes for the TEM attachment can be used to push and pull with screws. The holes are pass through but not completely threaded. Cylindrical pins need to be first placed inside the threads, then the fasteners.

2.5.2 Base plate positioning

Four oblong holes are machined on the base place to align it with the inserts of the composite structure. Their position is indicated in the picture below.
M5 fasteners can be used to bring the base plate in contact with the composite. Because of the previously mentioned problem with the inserts, there should not be much clearance for the assembly. Scratching the holes with the inserts could happen. If the plate seems to be stuck, the 4 fasteners should be used alternatively used until bringing the plate in contact with the structure. Torque should be limited to half of the tightening torque.

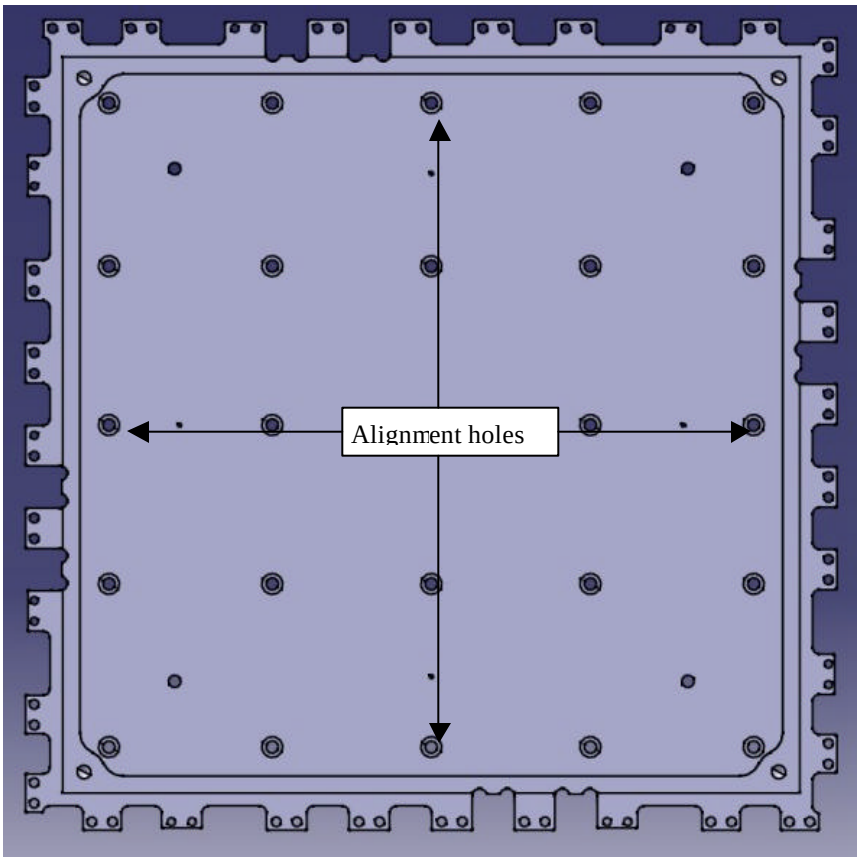

Figure 4: Position of the alignment holes

2.5.3 *Torquing*

25 M5 fasteners are used to attach the base plate to the inserts. The first 4 fasteners should be placed in the alignment holes to help positioning the base plate, as mentioned in 1.6.2, followed by the central fastener. Afterwards, the 20 remaining screws can be mounted. Running torque should be used for all those fasteners.
Once all the fasteners are in place, the tightening sequence presented in figure 5 should be used. Tightening should be first made at 50% of tightening torque, then 75% and finally full tightening torque.

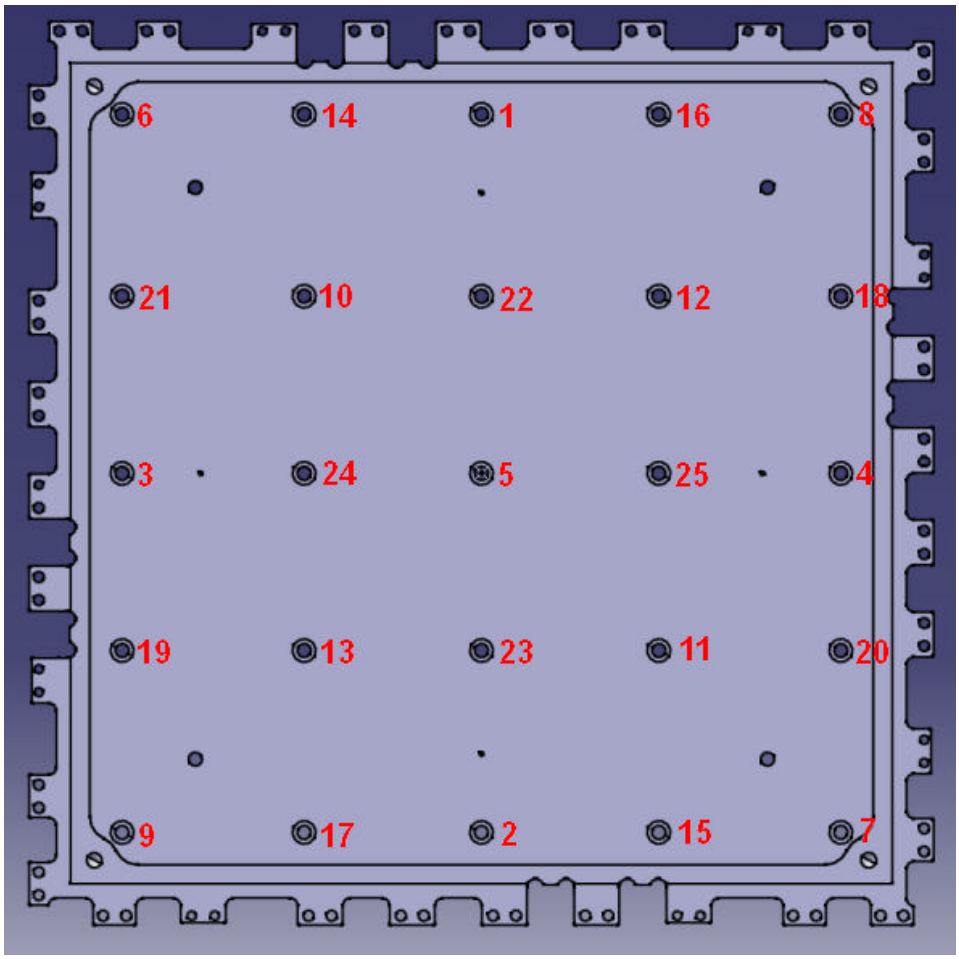

Figure 5: Torquing sequence for the attachment of the base plate

2.5.4 *Fasteners locking (preferably although not mandatory)*

The recommended procedure to lock the fasteners is a dot of epoxy adhesive. The dot should be placed between the fastener head and the recess in which it is sitting. Filling the socket head of the fastener should be avoided to allow removing the fastener if needed. The dot should be placed at the same position for all the fasteners.

The procedure is:

- Check tightening for of all the fasteners
- Apply one dot of adhesive as indicated in figure 6

- Wait TBD so that the epoxy is cured (recommended time before handling is 8-12h for 2216 but as soon as there is no risk of flowing it should be ok)

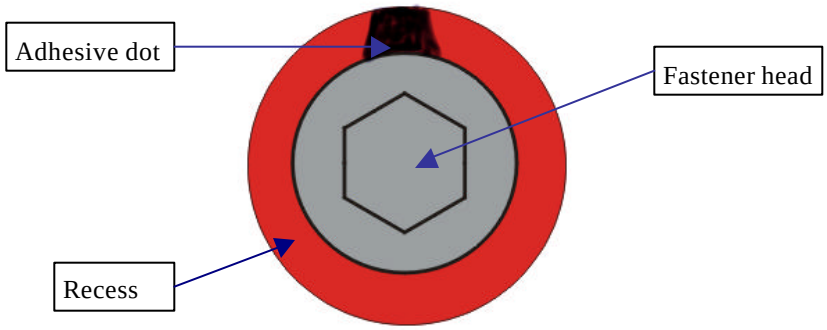

Figure 6: Position of the adhesive dot

2.6 TOP FRAME ASSEMBLY

2.6.1 Frame positioning

The top frame is positioned on the top of the composite structure the same way as the base plate, using 4 of the upper inserts.

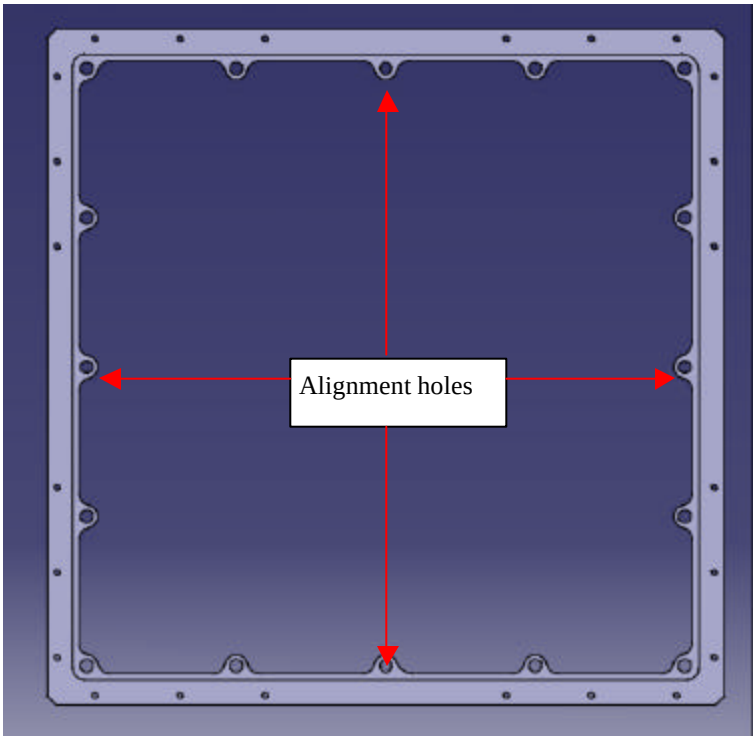

Figure 7: Alignment points for the top frame

2.6.2 *Torquing*

16 M4 fasteners are used to attach the top frame to the upper inserts of the composite structure. Assembly should start with the fasteners that mount to the alignment inserts. If needed, they should be used to bring in contact the frame and the composite. Mounting of the corner fasteners should follow and finally the 8 remaining fasteners.
Once all the fasteners are in place, the tightening sequence presented in figure 8 should be used. Tightening should be first made at 50% of tightening torque, then 75% and finally full tightening torque.

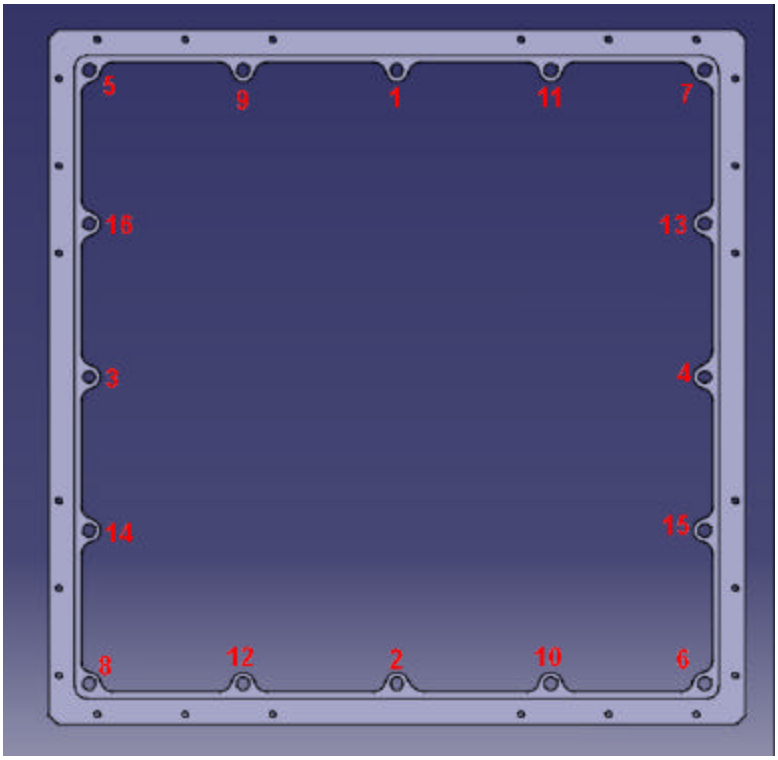

Figure 8: Torquing sequence for the attachment of the top frame

2.6.3 *Fasteners locking (preferably although not mandatory)*

The same procedure as the base plate should be used.

2.6.4 *Verification*

The alignment of the composite structure, base plate and top frame is given by 4 inserts in oblong holes. No metrology is needed to correctly assemble the 3 parts.